

APPENDIX H

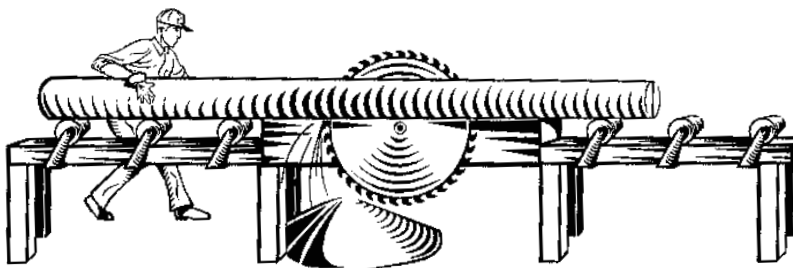
Modeling a Small-Scale Secondary Manufacturing Industry (D. Katz, SEACC)



Modeling a Small-Scale Secondary Manufacturing Timber Industry for Southeast Alaska

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“The reluctance on the part of some primary processors to implement a change of direction from volume to value strategy is due in large part to the fact that specialized markets necessitate far more management, greater attention to detail and added costs. These constraints pose very real problems....

“Because a value-added product will require more operations to be performed, the manufacturing process requires more people, creates more employment and requires greater attention because of the fussy nature of the specialty product business....[You must] be willing to develop different approaches to meet the requirements of this business which is very dissimilar to the commodity lumber business....”

**Douglas L. Cooper, Manager,
Logging Council of Forest Industries of British Columbia
Ketchikan, January 28, 1989² (Emphasis added)**

“Past efforts to develop the timber-using industry and the timber-based economy have partially relied on strategies that encouraged a few, large firms. The current situation offers an opportunity for some transition to a large number of smaller firms. Markets appear to be more economically accessible to these firms than in the past.”

**Charting a Course for Sustainable Development in Southeast Alaska,
US Forest Service Forest Products Lab, Madison, Wisconsin, Jan. 1996**

INTRODUCTION

We can learn a lot (but not everything) from our neighbors.

In British Columbia, secondary wood manufacturing is big business. In 1992, the British Columbia value-added timber industry had at least 565 plants, over 11,660 employees, and in 1990 had total sales revenues of \$1.54 billion.³

The high-value-added sector is the dynamically growing segment of the Pacific Northwest timber industry, too. According to the University of Washington's Center for International Trade in Forest Products (CINTRAFOR), exports of secondary products through the Columbia-Snake River Customs Districts, which include all of Washington and Oregon, increased 181% between 1989 and 1993.⁴

According to the Evergreen Partnership, a Tacoma-based membership corporation aiding secondary wood products manufacturers, there are an estimated 1,400 secondary wood products producers in the states of Washington and Oregon, employing 33,000 people.⁵ Exports of secondary wood products increased nearly 200% from 1989 through 1995, reaching \$300 million.⁶

Canada, British Columbia, the states of Washington and Oregon, US government and academic organizations, and the Northwest forest products industry itself have all made a substantial effort to identify potential markets and export opportunities for their region's secondary wood products. Trade shows, conferences and workshops occur frequently, linking secondary manufacturers from the Northwest with Pacific Rim buyers, particularly from Japan. So far, Alaska has no comparable effort.

It's time for a new timber industry. In 1950, around the time the long-term timber contracts were signed with the Ketchikan Pulp Company (KPC) and the Alaska Pulp Corporation (APC), Southeast Alaska's population was around 25,000. It is now approaching 75,000, and demands on the forest from users other than the timber industry have increased enormously. At the same time, the timber base has shrunk. Because the Tongass is a National Forest, pressures and concerns from Americans outside Alaska will continue to play a major role in Tongass decision-making.

The closure of the Ketchikan Pulp Company (KPC) pulp mill and ending of the last 50-year contract presents Southeast Alaskans the opportunity to build a new timber industry from the ground up, adopting what we think will work from BC and the PNW, and trying to create an industry that serves the needs of all Southeastern Alaskans and conserves our resources for the present and future. The challenge is to create a timber industry that produces a substantial number of timber jobs for Southeast Alaskans while remaining compatible with all the other uses of the Tongass—fishing, tourism, subsistence, fish and wildlife habitat, etc. To meet this challenge, we will need to take a new tack, and establish an industry that is very different from the one that was established for us by the long-term contracts.

An industry based on secondary manufacturing within the region is a necessity in Southeast Alaska. The new industry must produce local jobs by maximizing secondary wood product manufacturing, not by maintaining high levels of Tongass logging (half the

logging jobs go to non-residents anyway). A modern timber industry, based on the free market and producing finished and intermediate products out of solid wood holds the promise of these benefits:

- < The industry would comfortably exist on a lower logging level, thus helping ensure a stable timber supply. At the same time it would reduce threats to sensitive areas, conserve Tongass resources, and coexist with other segments of the economy.
- < It would encourage economic diversity, rather than dependence on a single large company that could wind up effectively controlling the resource and calling the shots.
- < It would produce more jobs for Southeast Alaskans on a lower cut. As configured below, the industry would produce as many as 18 direct jobs per million board (mmbf) feet utilized, similar to some regions in the PNW . The current Tongass timber industry produces only 5 jobs/mmbf.
- < It would operate much closer to the free market, thus saving scarce government funding for other beneficial development projects.

Below, we take a first stab at modeling such an industry.



Beth Antonsen designs and produces furniture in her Ketchikan workshop. “All of our wood in Southeast Alaska, including alder, is suitable for furniture and other objects,” she says, “Southeast Alaska could become the center of West Coast furniture production just as North Carolina is the regional center for the East Coast.”

THE MODELS

CONSTRUCTION OF THE MODELS

The models depict a Tongass timber industry based on secondary manufacturing, showing three different variations on a theme at each of three different logging levels—50 mmbf, 100 mmbf, and 150 mmbf. Thus, nine different scenarios are presented.

I first modeled the sawn wood and waste/chips production at each of these three logging levels. I then configured an industry and modeled the job outputs at each of these levels for (a) intensive secondary manufacturing (50% of the sawn product converted into intermediate and finished products); (b) moderate secondary manufacturing (40% of the sawn product converted into intermediate and finished products); and (c) lowest rate of secondary manufacturing (30% of the sawn product converted into intermediate and finished products).

There is nothing magic about the particular industry configuration I chose. I felt it was reasonable; however, other configurations would have been just as reasonable. Designing a configuration is inherently speculative, because no such industry has ever existed in Southeast Alaska before.

GENERAL RESULTS

The job numbers ranged from a low of 696 direct Tongass timber jobs at 50 million board feet (mmbf) logged and the lowest rate of secondary manufacture (14 jobs/mmbf), to a high of 2,729 direct Tongass timber jobs at 150 mmbf and intensive secondary manufacture (18 jobs per mmbf). By contrast, the current Tongass-dependent timber industry produces only 5 jobs/mmbf, and in 1995 produced 1,216 direct jobs, or just 3% of Southeast Alaska's total employment.

Secondary manufacturing produces very impressive job numbers. Even when I took the lowest rate of secondary processing and cut it in half on the assumption that it could take some time for the new Tongass secondary industry to achieve the full rate of job production, total jobs still equaled 10 per mmbf. This rate is roughly double the current rate, and would provide all the direct timber jobs provided by the in the Tongass in 1995 (1,216)—but on a much lower cut of 122 mmbf.

In the modeled industry, logging and sawmilling provided only 33%-38% of the jobs. High-value-added operations, from doors and windows to furniture and miscellaneous cottage products, produced 62%-67% of the jobs.

The rate of local job production for Southeast Alaskans potentially achievable through secondary manufacturing dwarfs the jobs rate of the current industry. This new industry, very dissimilar from the current industry, is where Southeast Alaska needs to head.

OVERALL ASSUMPTIONS

- < The models address Tongass timber only. Native Corporation or State of Alaska timber can be added in as appropriate. Timber supply proportions: Cedar 12% (red 6% + yellow 6%); Hemlock 60%; Spruce 28%.
- < Jobs are produced from the production of solid wood products only. There are no fiber-plant or other fiber-based jobs modeled. Solid wood products are finished to the same extent they are finished in B.C. and the PNW, from which the job numbers are largely derived.
- < No round-log export. Cedar round-log export has been phased out. All logs are primary-processed within Southeast Alaska. Cedar, spruce and hemlock are sawn and remanufactured equally to the extent shown in each model.
- < Small-diameter sawlogs are mainly sawed (rather than pulped).⁷ Overall, 80% of the timber supply is sawed. Sawmilling produces an average 30% overrun⁸ in lumber tally.
- < Job numbers per unit volume derived from Forest Service ANILCA 706(a) reports; Structure and Significance of the Value-added Wood Products Industry in British Columbia (Canada-British Columbia Partnership Agreement on Forest Development, January, 1995 (FRDA Report 203)(hereinafter, BC Wood); personal visits to, and conversations with, Washington secondary manufacturers in May 1996; USFS, Charting a Sustainable Future for Southeast Alaska (January 1996); and data from the President's Forest Plan for the Pacific Northwest (FEMAT), 1993.

CAVEATS

- < The modeling of the industry at any particular logging level does not in any way imply an endorsement of that logging level, or a judgment that that logging level is sustainable for all Tongass resources or is desirable for the forest. The purpose is to develop a snapshot of what could be done at that level.
- < The particular industry configurations modeled here are not the most important thing about the modeling. Altered configurations would produce similar results. The fully developed high-value-added industry modeled here is a target that will take time to achieve. Nonetheless, it is the goal we should shoot for.

TONGASS LOGGING LEVEL: 50 MMBF

		Total Roundwood	20% Unsaable	80% Sawable	Saw Overrun	Total Sawn Product
12% Cedar (6% red, 6% yellow)	=	6 mmbf	1.2 mmbf	4.8 mmbf	X 1.3 =	6.2 mmbf
60% Hemlock	=	30 mmbf	6 mmbf	24 mmbf	X 1.3 =	31.2 mmbf
28% Spruce	=	14 mmbf	2.8 mmbf	11.2 mmbf	X 1.3 =	14.6 mmbf
Subtotals	=	50 mmbf	10 mmbf	40 mmbf	X 1.3 =	52 mmbf
Residual chips & waste	=		<u>10-15 mmbf</u>			<u> </u>
			20-25 mmbf total chips and waste*			52 mmbf total sawn product

TONGASS LOGGING LEVEL: 100 MMBF

		Total Roundwood	20% Unsaable	80% Sawable	Saw Overrun	Total Sawn Product
12% Cedar (6% red, 6% yellow)	=	12 mmbf	2.4 mmbf	9.6 mmbf	X 1.3 =	12.5 mmbf
60% Hemlock	=	60 mmbf	12 mmbf	48 mmbf	X 1.3 =	62.4 mmbf
28% Spruce	=	28 mmbf	5.6 mmbf	22.4 mmbf	X 1.3 =	29.1 mmbf
Subtotals	=	100 mmbf	20 mmbf	80 mmbf	X 1.3 =	104 mmbf
Residual chips & waste	=		<u>20-30 mmbf</u>			<u> </u>
			40-50 mmbf total chips and waste*			104 mmbf total sawn product

TONGASS LOGGING LEVEL: 150 MMBF

		Total Roundwood	20% Unsaable	80% Sawable	Saw Overrun		Total Sawn Product
12% Cedar (6% red, 6% yellow)	=	18 mmbf	3.6 mmbf	14.4 mmbf	X 1.3	=	18.7 mmbf
60% Hemlock	=	90 mmbf	18 mmbf	72 mmbf	X 1.3	=	93.6 mmbf
28% Spruce	=	42 mmbf	8.4 mmbf	33.6 mmbf	X 1.3	=	43.7 mmbf
Subtotals	=	150 mmbf	30 mmbf	120 mmbf	X 1.3	=	156 mmbf
Residual chips & waste	=		<u>30-45 mmbf</u>				
			60-75 mmbf total chips and waste*				156 mmbf total sawn product

*How can processing 50 mmbf log scale result in a greater total processed volume of lumber, chips and waste?
 “Overrun,” due in part to log taper . Another way of saying this is that board foot measure understates total available cubic volume.

JOBS PRODUCED AT 50 MMBF LOG SCALE: INTENSIVE SECONDARY MANUFACTURE (50%) (SCENARIO 1)

Assumptions: half the lumber product is sold in that form (export or local), and half is graded, sorted, and re-manufactured within Southeast Alaska into finished or semi-finished products. Total logging jobs: 100.

Logging jobs: 100

Total sawn product: 51 mmbf; Log homes 1 mmbf

Waste and chips: 20-25 mmbf

<u>Facility and Application</u>	<u>Amount of wood</u>	<u>Direct jobs per mmbf</u>	<u>Total jobs</u>
<i>Log homes:</i>	1 mmbf	41	41
<i>Breakdown milling:</i> Sawmills, planer mills, drykilns 25.5 mmbf Dried and surfaced dimensional lumber for Alaska consumption and export—		2	51
<i>Breakdown, grading, and remanufacturing:</i> Sawmills, planer mills, drykilns, intensive grading in sortyard, remanufacturing: chop lines, finger-jointers, edge-glueers, specialty and intermediate products, remanufactured clear components, source for:	25.5 mmbf	6	153
<i>Turning plant:</i>	1.5 mmbf	26.7	40
<i>Door plant:</i>	18 mmbf	17	306
<i>Window plant:</i>	3 mmbf	27.5	83
<i>Laminated beams:</i>	1 mmbf	11	11
<i>Furniture:</i>	1 mmbf	29	29
<i>Shingles:</i>	0.5 mmbf	10	5
<i>Cabinets:</i>	0.1 mmbf	558	56
<i>Cottage industry/other products:</i>	0.4 mmbf	88	35
Subtotal, secondary manufacture:			565

Subtotals

Logging	100
Log homes	41
Breakdown	51
Breakdown with intensive sorting and reman:	153
Intensive secondary manufacture:	<u>565</u>
Total jobs:	910
Jobs/mmbf log scale:	18

Of note:

1. The total jobs/mmbf number approximates the actual jobs/mmbf figure reported by the Forest Service for areas in Oregon where secondary manufacturing is prevalent (16 jobs/mmbf).
2. The door plant does not need all clear components. Thin veneers sliced from clear blocks cover lower-grade components, providing a clear appearance and greatly increasing the value of the product.
3. Sources of jobs/mmbf figures: Logging: USFS ANILCA 706 (a) reports; Log homes: BC Wood; Turning plant: actual turning plant north of Seattle; door plant: actual door plant in Tacoma; window plant: derived from review of Viking Lumber in USFS, *Charting a Sustainable Future for Southeast Alaska* (this figure understates the BC Wood figure); laminated beams: BC Wood; Furniture: BC Wood; Shingles: estimate of actual (anecdotal evidence suggests this figure may also be low); Cabinets: BC Wood; Cottage industry/other products: estimate of actual.

JOBS PRODUCED AT 50 MMBF LOG SCALE: MODERATE SECONDARY MANUFACTURE (40%) (SCENARIO 2)

Assumptions: 20% of the sawn product (10.2 mmbf) is high-grade flitch, which is exported. Half the remaining 40.8 mmbf (20.4 mmbf) is sold as domestic or export lumber and half (20.4 mmbf, or 40% of the total) is remanufactured within Southeast Alaska into finished or semi-finished products.

Logging jobs: 100

Total sawn product: 51 mmbf; Log homes: 1 mmbf

Waste and chips: 20-25 mmbf

<u>Facility and Application</u>	<u>Amount of wood</u>	<u>Direct jobs per mmbf</u>	<u>Total jobs</u>
<i>Log homes:</i>	1 mmbf	41	41
<i>Breakdown milling:</i> Sawmills, planer mills, drykilns	30.6 mmbf	2	61
Dried and surfaced dimensional lumber and high-grade flitch for Alaska consumption and export—	(10.2 + 20.4) (see above)		
<i>Breakdown, intensive grading, and remanufacturing:</i>	20.4 mmbf	6	122
Sawmills, planer mills, drykilns, intensive grading in sortyard, remanufacturing: chop lines, finger-jointers, edge-glue, producing: specialty and intermediate products, remanufactured clear components, raw material for:	(60% of total 51)		
<i>Turning plant(s):</i>	1.5 mmbf	26.7	40
<i>Door plant(s):</i>	12.9 mmbf	17	219
<i>Window plant(s):</i>	3 mmbf	27.5	83
<i>Laminated beams:</i>	1 mmbf	11	11
<i>Furniture:</i>	1 mmbf	29	29
<i>Shingles:</i>	0.5 mmbf	10	5
<i>Cabinets:</i>	0.1 mmbf	558	56
<i>Cottage industry/other products:</i>	0.4 mmbf	88	35
Subtotal, secondary manufacture:			478

Subtotals

Logging	100
Log homes	41
Breakdown: domestic and export lumber:	61
Breakdown with intensive sorting and reman:	122
Intensive secondary manufacture:	478
Total jobs:	802
Jobs/mmbf log scale:	16

Of note:

1. The total jobs/mmbf number matches the actual jobs/mmbf figure reported by the Forest Service for areas in Oregon where secondary manufacturing is prevalent (16 jobs/mmbf).

JOBS PRODUCED AT 50 MMBF LOG SCALE: LOWEST RATE OF SECONDARY MANUFACTURE (30%) (SCENARIO 3)

Assumptions: 40% of the sawn product (20.4 mmbf) is high-grade slicing flitch, which is exported. Half the remaining 30.6 mmbf, half (15.3 mmbf) is sold as domestic or export dimensional lumber and half (15.3 mmbf, or 30% of the total) is remanufactured locally into finished or semi-finished products.

Logging jobs: 100

Total sawn product: 51 mmbf; Log homes: 1 mmbf

Waste and chips: 20-25 mmbf

<u>Facility and Application</u>	<u>Amount of wood</u>	<u>Direct jobs</u>	<u>per mmbf</u>	<u>Total jobs</u>
<i>Log homes:</i>	1 mmbf	41	41	
<i>Breakdown milling:</i> Sawmills, planer mills, drykilns	35.7 mmbf	2	71	
Dried and surfaced dimensional lumber for Alaska consumption and export—	(70% of total 51)			
<i>Breakdown, intensive grading, and remanufacturing:</i>	15.3 mmbf	6	92	
Sawmills, planer mills, drykilns, intensive grading in sortyard, remanufacturing: chop lines, finger-jointers, edge-glueers, specialty and intermediate products, remanufactured clear components, source for:	(30% of total 51)			
Turning plant:	1.5 mmbf	26.7	40	
Door plant:	7.8 mmbf	17	133	
Window plant:	3 mmbf	27.5	83	
Laminated beams:	1 mmbf	11	11	
Furniture:	1 mmbf	29	29	
Shingles:	0.5 mmbf	10	5	
Cabinets:	0.1 mmbf	558	56	
Cottage industry/other products:	0.4 mmbf	88	35	
Subtotal, secondary manufacture:			392	

Subtotals

Logging	100
Log homes	41
Breakdown: domestic and export lumber:	71
Breakdown with intensive sorting and reman:	92
Intensive secondary manufacture:	392
Total jobs:	696
Jobs/mmbf log scale:	14

What if we don't get all this job production?

Assume, in the near-term, that only half the 30% available for secondary manufacturing actually received it, or alternatively that in the near term Southeast Alaska achieved only half the job production currently achieved in B.C. and the PNW for similar operations.

< Intensive secondary manufacturing jobs: $392/2 = 196$

< Total jobs: 500, or 10 jobs/mmbf

Current (1995) direct, Tongass-only timber job production: 1,216 total, or 5 jobs/mmbf on a cut of 222 mmbf. **Thus, even if only 15% of the cut received intensive secondary manufacturing, this industry would double the current jobs/mmbf figure, and a cut of 122 mmbf would provide all the jobs of the current industry.**

JOBS PRODUCED AT 100 MMBF LOG SCALE: INTENSIVE SECONDARY MANUFACTURE (50%) (SCENARIO 4)

Assumptions: half the lumber product is sold in that form (export or local), and half is graded, sorted, and re-manufactured within Southeast Alaska into finished or semi-finished products. Total logging jobs: 200.

Logging jobs: 200

Total sawn product: 102 mmbf; Log homes 2 mmbf

Waste and chips: 40-50 mmbf

<u>Facility and Application</u>	<u>Amount of wood</u>	<u>Direct jobs per mmbf</u>	<u>Total jobs</u>
<i>Log homes:</i>	2 mmbf	41	82
<i>Breakdown milling:</i> Sawmills, planer mills, drykilns 51 mmbf Dried and surfaced dimensional lumber for Alaska consumption and export—	2	102	
<i>Breakdown, grading, and remanufacturing:</i> Sawmills, planer mills, drykilns, intensive grading in sortyard, remanufacturing: chop lines, finger-jointers, edge-glue, specialty and intermediate products, remanufactured clear components, source for:	51 mmbf	6	306
<i>Turning plant(s):</i>	3 mmbf	26.7	80
<i>Door plant(s):</i>	36 mmbf	17	612
<i>Window plant(s):</i>	6 mmbf	27.5	165
<i>Laminated beams:</i>	2 mmbf	11	22
<i>Furniture:</i>	2 mmbf	29	58
<i>Shingles:</i>	1 mmbf	10	10
<i>Cabinets:</i>	0.2 mmbf	558	112
<i>Cottage industry/other products:</i>	0.8 mmbf	88	70
Subtotal, secondary manufacture:			1,129

Subtotals

Logging	200
Log homes	82
Breakdown	102
Breakdown with intensive sorting and reman:	306
Intensive secondary manufacture:	<u>1,129</u>
Total jobs:	1,819
Jobs/mmbf log scale:	18

Of note:

1. The total jobs/mmbf number approximates the actual jobs/mmbf figure reported by the Forest Service for areas in Oregon where secondary manufacturing is prevalent (16 jobs/mmbf).
2. The door plant does not need all clear components. Thin veneers sliced from clear blocks cover lower-grade components, providing a clear appearance and greatly increasing the value of the product.
3. Sources of jobs/mmbf figures: Logging: USFS ANILCA 706 (a) reports; Log homes: BC Wood; Turning plant: actual turning plant north of Seattle; door plant: actual door plant in Tacoma; window plant: derived from review of Viking Lumber in USFS, *Charting a Sustainable Future for Southeast Alaska* (this figure understates the BC Wood figure); laminated beams: BC Wood; Furniture: BC Wood; Shingles: estimate of actual (anecdotal evidence suggests this figure may also be low); Cabinets: BC Wood; Cottage industry/other products: estimate of actual.

JOBS PRODUCED AT 100 MMBF LOG SCALE: MODERATE SECONDARY MANUFACTURE (40%) (SCENARIO 5)

Assumptions: 20% of the sawn product (20.4 mmbf) is high-grade flitch, which is exported. Half the remaining 81.6 mmbf (40.8 mmbf) is sold as domestic or export lumber and half (40.8 mmbf, or 40% of the total) is remanufactured within Southeast Alaska into finished or semi-finished products.

Total logging jobs: 200

Total sawn product: 102 mmbf; Log homes: 2 mmbf

Waste and chips: 40-50 mmbf

<u>Facility and Application</u>	<u>Amount of wood</u>	<u>Direct jobs per mmbf</u>	<u>Total jobs</u>
<i>Log homes:</i>	2 mmbf	41	82
<i>Breakdown milling:</i> Sawmills, planer mills, drykilns	61.2 mmbf	2	122
Dried and surfaced dimensional lumber and high-grade flitch for Alaska consumption and export—	(20.4 + 40.8) (60% of total)		
<i>Breakdown, intensive grading, and remanufacturing:</i>	40.8 mmbf	6	245
Sawmills, planer mills, drykilns, intensive grading in sortyard, remanufacturing: chop lines, finger-jointers, edge-glueers, producing: specialty and intermediate products, remanufactured clear components, raw material for:	(40% of total)		
<i>Turning plant(s):</i>	3 mmbf	26.7	80
<i>Door plant(s):</i>	25.8 mmbf	17	439
<i>Window plant(s):</i>	6 mmbf	27.5	165
<i>Laminated beams:</i>	2 mmbf	11	22
<i>Furniture:</i>	2 mmbf	29	58
<i>Shingles:</i>	1 mmbf	10	10
<i>Cabinets:</i>	0.2 mmbf	558	112
<i>Cottage industry/other products:</i>	0.8 mmbf	88	70
Subtotal, secondary manufacture:			956

Subtotals

Logging	200
Log homes	82
Breakdown: domestic and export lumber:	122
Breakdown with intensive sorting and reman:	244
Intensive secondary manufacture:	956
Total jobs:	1,604
Jobs/mmbf log scale:	16

Of note:

1. The total jobs/mmbf number matches the actual jobs/mmbf figure reported by the Forest Service for areas in Oregon where secondary manufacturing is prevalent (16 jobs/mmbf).

JOBS PRODUCED AT 100 MMBF LOG SCALE: LOWEST RATE OF SECONDARY MANUFACTURE (30%) (SCENARIO 6)

Assumptions: 40% of the sawn product (40.8 mmbf) is high-grade slicing flitch, which is exported. Of the remaining 61.2 mmbf, half (30.6 mmbf) is sold as domestic or export dimensional lumber and half (30.6 mmbf, or just 30% of the total) is remanufactured locally into finished or semi-finished products.

Logging jobs: 200

Total sawn product: 102 mmbf; Log homes: 2 mmbf

Waste and chips: 40-50 mmbf

<u>Facility and Application</u>	<u>Amount of wood</u>	<u>Direct jobs per mmbf</u>	<u>Total jobs</u>
<i>Log homes:</i>	2 mmbf	41	82
<i>Breakdown milling:</i> Sawmills, planer mills, drykilns	71.4 mmbf	2	143
Dried and surfaced dimensional lumber for Alaska consumption and export—	(70% of total 102)		
<i>Breakdown, intensive grading, and remanufacturing:</i>	30.6 mmbf	6	184
Sawmills, planer mills, drykilns, intensive grading in sortyard, remanufacturing: chop lines, finger-jointers, edge-glueers, specialty and intermediate products, remanufactured clear components, source for:	(30% of total 102)		
<i>Turning plant:</i>	3 mmbf	26.7	80
<i>Door plant:</i>	15.6 mmbf	17	265
<i>Window plant:</i>	6 mmbf	27.5	165
<i>Laminated beams:</i>	2 mmbf	11	22
<i>Furniture:</i>	2 mmbf	29	58
<i>Shingles:</i>	1 mmbf	10	10
<i>Cabinets:</i>	0.2 mmbf	558	112
<i>Cottage industry/other products:</i>	0.8 mmbf	88	70
Subtotal, secondary manufacture:			782

Subtotals

Logging	200
Log homes	82
Breakdown: domestic and export lumber:	142
Breakdown with intensive sorting and reman:	184
Intensive secondary manufacture:	<u>782</u>
Total jobs:	1,390
Jobs/mmbf log scale:	14

What if we don't get all this job production?

Assume, in the near-term, that only half the 30% available for secondary manufacturing actually received it, or alternatively that in the near term Southeast Alaska achieved only half the job production currently achieved in B.C. and the PNW for similar operations.

< Intensive secondary manufacturing jobs: $772/2 = 386$

< Total jobs: 994, or 10 jobs/mmbf

< Current (1995) direct, Tongass-only timber job production: 1,216 total, or 5 jobs/mmbf on a cut of 222. **Thus, even if only 15% of the cut received intensive secondary manufacturing, this industry would double the current jobs/mmbf figure, and a cut of 122 mmbf would provide all the jobs of the current industry.**

JOBS PRODUCED AT 150 MMBF LOG SCALE: INTENSIVE SECONDARY MANUFACTURE (50%) (SCENARIO 7)

Assumptions: half the lumber product is sold in that form (export or local), and half is graded, sorted, and re-manufactured within Southeast Alaska into finished or semi-finished products. Total logging jobs: 300.

Logging jobs: 300

Total sawn product: 153 mmbf; Log homes 3 mmbf

Waste and chips: 60-75 mmbf

<u>Facility and Application</u>	<u>Amount of wood</u>	<u>Direct jobs per mmbf</u>	<u>Total jobs</u>
<i>Log homes:</i>	3 mmbf	41	123
<i>Breakdown milling:</i> Sawmills, planer mills, drykilns Dried and surfaced dimensional lumber for Alaska consumption and export—	76.5 mmbf	2	153
<i>Breakdown, grading, and remanufacturing:</i> Sawmills, planer mills, drykilns, intensive grading in sortyard, remanufacturing: chop lines, finger-jointers, edge-glueers, specialty and intermediate products, remanufactured clear components, source for:	76.5 mmbf	6	459
<i>Turning plant(s):</i>	4.5 mmbf	26.7	120
<i>Door plant(s):</i>	54 mmbf	17	918
<i>Window plant(s):</i>	9 mmbf	27.5	248
<i>Laminated beams:</i>	3 mmbf	11	33
<i>Furniture:</i>	3 mmbf	29	87
<i>Shingles:</i>	1.5 mmbf	10	15
<i>Cabinets:</i>	0.3 mmbf	558	167
<i>Cottage industry/other products:</i>	1.2 mmbf	88	106
Subtotal, secondary manufacture:			1,694

Subtotals

Logging	300
Log homes	123
Breakdown	153
Breakdown with intensive sorting and reman:	459
Intensive secondary manufacture:	1,694
Total jobs:	2,729
Jobs/mmbf log scale:	18

Of note:

1. The total jobs/mmbf number approximates the actual jobs/mmbf figure reported by the Forest Service for areas in Oregon where secondary manufacturing is prevalent (16 jobs/mmbf).
2. The door plant does not need all clear components. Thin veneers sliced from clear blocks cover lower-grade components, providing a clear appearance and greatly increasing the value of the product.
3. Sources of jobs/mmbf figures: Logging: USFS ANILCA 706 (a) reports; Log homes: *BC Wood*; Turning plant: actual turning plant north of Seattle; door plant: actual door plant in Tacoma; window plant: derived from review of Viking Lumber in USFS, *Charting a Sustainable Future for Southeast Alaska* (this figure understates the *BC Wood* figure); laminated beams: *BC Wood*; Furniture: *BC Wood*; Shingles: estimate of actual; Cabinets: *BC Wood*; Cottage industry/other products: estimate of actual.

JOBS PRODUCED AT 150 MMBF LOG SCALE: MODERATE SECONDARY MANUFACTURE (40%) (SCENARIO 8)

Assumptions: 2% of the total logged is devoted to log homes. 20% of the sawn product (30.6 mmbf) is high-grade flitch, which is exported. Half the remaining 122.4 mmbf (61.2 mmbf) is sold as domestic or export lumber and half (61.2 mmbf, or 40% of the total) is remanufactured within Southeast Alaska into finished or semi-finished products.

Total logging jobs: 300

Total sawn product: 153 mmbf; Log homes: 3 mmbf

Waste and chips: 60-75 mmbf

<u>Facility and Application</u>	<u>Amount of wood</u>	<u>Direct jobs per mmbf</u>	<u>Total jobs</u>
<i>Log homes:</i>	3 mmbf	41	123
<i>Breakdown milling:</i> Sawmills, planer mills, drykilns	91.8 mmbf	2	184
Dried and surfaced dimensional lumber and high-grade flitch for Alaska consumption and export—	(30.6 + 61.2) (60% of total)		
<i>Breakdown, intensive grading, and remanufacturing:</i>	61.2 mmbf	6	367
Sawmills, planer mills, drykilns, intensive grading in sortyard, remanufacturing: chop lines, finger-jointers, edge-glueers, producing: specialty and intermediate products, remanufactured clear components, raw material for:	(40% of total)		
<i>Turning plant(s):</i>	4.5 mmbf	26.7	120
<i>Door plant(s):</i>	38.7 mmbf	17	658
<i>Window plant(s):</i>	9 mmbf	27.5	248
<i>Laminated beams:</i>	3 mmbf	11	33
<i>Furniture:</i>	3 mmbf	29	87
<i>Shingles:</i>	1.5 mmbf	10	15
<i>Cabinets:</i>	0.3 mmbf	558	167
<i>Cottage industry/other products:</i>	1.2 mmbf	88	106
Subtotal, secondary manufacture:			1,434

Subtotals

Logging	300
Log homes	123
Breakdown: domestic and export lumber:	184
Breakdown with intensive sorting and reman:	367
Intensive secondary manufacture:	<u>1,434</u>
Total jobs:	2,408
Jobs/mmbf log scale:	16

Of note:

1. The total jobs/mmbf number matches the actual jobs/mmbf figure reported by the Forest Service for areas in Oregon where secondary manufacturing is prevalent (16 jobs/mmbf).

JOBS PRODUCED AT 150 MMBF LOG SCALE: LOWEST RATE OF SECONDARY MANUFACTURE (30%) (SCENARIO 9)

Assumptions: 40% of the sawn product (61.2 mmbf) is high-grade slicing flitch, which is exported. Of the remaining 91.8 mmbf, half (45.9 mmbf) is sold as domestic or export dimensional lumber and half (45.9 mmbf, or just 30% of the total) is remanufactured locally into finished or semi-finished products.

Logging jobs: 300

Total sawn product: 153 mmbf; Log homes: 3 mmbf

Waste and chips: 60-75 mmbf

<u>Facility and Application</u>	<u>Amount of wood</u>	<u>Direct jobs per mmbf</u>	<u>Total jobs</u>
<i>Log homes:</i>	3 mmbf	41	123
<i>Breakdown milling:</i> Sawmills, planer mills, drykilns	107.1 mmbf	2	214
Dried and surfaced dimensional lumber for Alaska consumption and export—	(70% of total 102)		
<i>Breakdown, intensive grading, and remanufacturing:</i>	45.9 mmbf	6	275
Sawmills, planer mills, drykilns, intensive grading in sortyard, remanufacturing: chop lines, finger-jointers, edge-glue, specialty and intermediate products, remanufactured clear components, source for:	(30% of total 102)		
<i>Turning plant(s):</i>	4.5 mmbf	26.7	120
<i>Door plant(s):</i>	23.4 mmbf	17	398
<i>Window plant(s):</i>	9 mmbf	27.5	248
<i>Laminated beams:</i>	3 mmbf	11	33
<i>Furniture:</i>	3 mmbf	29	87
<i>Shingles:</i>	1.5 mmbf	10	15
<i>Cabinets:</i>	0.3 mmbf	558	167
<i>Cottage industry/other products:</i>	1.2 mmbf	88	106
Subtotal, secondary manufacture:			1,174

Subtotals

Logging	300
Log homes	123
Breakdown: domestic and export lumber:	214
Breakdown with intensive sorting and reman:	275
Intensive secondary manufacture:	1,174
Total jobs:	2,086
Jobs/mmbf log scale:	14

What if we don't get all this job production?

Assume, in the near-term, that only half the 30% available for secondary manufacturing actually received it, or alternatively that in the near term Southeast Alaska achieved only half the job production currently achieved in B.C. and the PNW for similar operations.

< Intensive secondary manufacturing jobs: $1,174/2 = 587$

< Total jobs: 1,499, or 10 jobs/mmbf

< Current (1995) direct, Tongass-only timber job production: 1,216 total, or 5 jobs/mmbf on a cut of 222. **Thus, even if only 15% of the cut received intensive secondary manufacturing, this industry would double the current jobs/mmbf figure, and a cut of 122 mmbf would provide all the jobs of the current industry.**

RECENT DEVELOPMENTS

The pressure on Southeast Alaska's timber industry to evolve from a volume-based to a value-added industry mirrors similar pressures that occurred in the Pacific Northwest and British Columbia, as available logging volumes declined, non-timber uses of public forests increased, and competition drove changes in technology. Since the draft of this paper was published and circulated among members of the Governor's Timber Task Force, a number of other reports have been published, and several events have occurred, tending to support the notion that Southeast Alaska's timber industry faces fundamental change, and that a transition to a high-value-added industry is already beginning.

1. The Forest Service released the long-awaited Tongass Land Management Plan (TLMP). The annual allowable cutting level is lower than the level that industry representatives had claimed was necessary to sustain the timber industry in Southeast Alaska. In its paper entitled *Four Visions of the Timber Industry in Southeast Alaska*, and especially in its presentation to the Governor's Timber Task Force, the Alaska Forest Association (AFA) argued that an annual cutting level of 300 mmbf was necessary to prevent the industry from "unraveling." While the AFA paper considered lower logging levels, it asserted that lower levels would very likely be insufficient to sustain the various essential components of an industry. Among those essential components was a medium density fiberboard (MDF) plant.

Since the AFA presented its report (at the same Timber Task Force meeting at which SEACC presented the draft of this paper), the Forest Service has released the new TLMP. The annual Allowable Sale Quantity (ASQ) contained in the Record of Decision is 267 mmbf, and the Forest Service is predicting that actual timber offerings and annual cutting levels may often be significantly lower. While SEACC views that ASQ number as too high, it is well below the minimum level the AFA advocated as necessary to sustain its vision of the future. Moreover, the draft Timber Task Force report itself indicates that an MDF plant would have great trouble competing from Southeast Alaska against lower-48 plants with access to cheaper raw materials and better proximity to markets. Thus, based on the AFA's own arguments, the industry will need to re-make itself.

2. Recent reports by the U.S. Forest Service's Pacific Northwest Research Station, the USFS' Madison, Wisconsin Forest Products Laboratory, and the Timber Task Force itself all suggest that change is coming to Southeast's timber industry, and that a transition to a value-added industry is possible and/or likely.

(a) **PNW Station demand predictions.** As part of the TLMP effort, Pacific Northwest Research Station economists David Brooks and Richard Haynes predicted that timber demand levels on the Tongass will be significantly lower than they have been in the past, as a result of the closure of the two Tongass pulp mills and long-term trends in markets for Alaska products. In their paper *Timber Products Output and Timber Harvests in Alaska: Projections for 1997-2010*, Brooks and Haynes projected timber demand over that time period to range from 65-206 mmbf, based on different demand scenarios, with a median level of approximately 135 mmbf. While acknowledging some uncertainty in their predictions, the authors stated that a scenario in which approximately 100 mmbf of timber is logged annually was "plausible," and that additional value-added operations could be implemented despite these lower predicted demand levels. These demand predictions are far lower than the authors' past predictions using similar

methodology, and reflect a structurally different industry—one based on sawmills, not pulp mills.

(b) **Forest Products Lab efforts.** In several visits to Southeast Alaska, the Forest Service's Madison, Wisconsin Forest Products Lab determined that Southeast Alaska's timber supply was of generally high quality, and suitable for producing a variety of sawn products.⁹ The Lab is working with industry to aid potential producers of value-added products in Southeast Alaska.

The Lab's consultant George Harpole developed a model of an integrated sawmilling industry including high-value-added products, and cited a list of 116 potential special-purpose wood products, developed by industry consultant Gene Wengert and presented by Wengert at workshops in Southeast communities. In his March 11, 1997 draft report entitled *Setting a Course for the Future*, Harpole also pointed out the opportunity to market products as originating in Alaska was unique and potentially very valuable in and of itself. Sawmills as small as 7.5 mmbf/yr could fully utilize their log supplies by producing a variety of products, ranging from lumber to bagged products like mulch. Low-quality wood, wood chips and waste could be manufactured into products such as wood-cement particleboard (but importantly, as explained by Harpole, subject to cost and commodity competition problems similar to those affecting MDF).

(c) **The Timber Task Force's draft report was released. It recognizes the trend in the Pacific Northwest and British Columbia away from volume-based strategies and towards a value-added industry, as well as extensive support efforts in the PNW and B.C.** The Timber Task Force's draft report recognizes the importance of extensive efforts in the Pacific Northwest and British Columbia to facilitate the transition to a value-added industry and support that industry through marketing, technical advice, financial incentives, and other measures.¹⁰ The report recognized the fundamental changes taking place in the Southeast Alaska timber industry and considered ways to support a transition to a value-added industry. It also pointed out the very significant competitive disadvantages that an MDF plant, in particular, would face in competing against lower-48 plants with better access to both raw materials and markets.¹¹ By extension, other large-scale fiber-based manufacturing operations may face similar problems, making a value-added strategy all the more important. While pointing out the need for economic utilization or disposal of low-quality logs and waste, it also discussed some promising projects along these lines, such as a wood-and-fish-waste composting method now being examined by several groups within the region.

Importantly, none of these reports assert that in order to survive the Southeast Alaska timber industry must cut a high volume, such as 300 mmbf per year. All of them expect the industry to be very different, smaller, and/or more value-based, than it has been in the past.

3. In August 1997, Steve Seley of Ketchikan broke ground on a new, high-value-added sawmill, indicating that industry transition is occurring not just in theory, but in fact. The new Seley Log and Lumber mill will process approximately 14.4 mmbf per year. The mill complex will include a drying kiln and additional remanufacturing capabilities, as well as facilities dedicated for the use of other secondary manufacturers, who could use Seley's kiln-dried lumber as raw material for their own products. In addition to kiln-dried lumber for further manufacture, Seley plans to produce lumber for local construction, cants and flitches for export, remanufactured clear pieces, and other products. An initiative to do wood-and-fish-waste composting on site is now on a back burner as a result of necessary changes to the initial site plan.

Importantly, Seley is also looking for the opportunity to supply his mill using helicopters and selection logging techniques. This approach, minimizing new roads and clearcuts, holds a number benefits for other forest users, and would provide for conservation of fish and wildlife habitat far better than historical Tongass roading and clearcutting policies.

SOME INDUSTRY REACTION TO THE DRAFT OF THIS PAPER

I invited members of the Timber Task Force to respond to the draft of this paper. I received comments from Steve Seley of Seley Log and Lumber and Errol Champion of Silver Bay Logging. Their primary concerns had to do with establishing a sufficient and reliable timber supply from the Tongass National Forest.

Seley thought that a value-added industry was possible and desirable, but that SEACC's modeling of such an industry didn't reach the real problem—how to ensure a reliable supply of timber for such an industry. Champion thought that current log transportation and distribution systems were not set up to handle the lower volumes of timber and the smaller manufacturing operations suggested by the SEACC model. Champion also felt that investors were looking for a “guaranteed” level of fiber supply, and that disposing of the utility grade fiber remained a challenge. He identified today's sorts as often classing 50% of the log supply as grade #3 or poorer.

In addition, some in the Timber Task Force questioned whether secondary manufacturing operations could compete from Southeast Alaska.

SOME RESPONSES

Core timber supply. For a variety of reasons including changing public attitudes, increased demand for non-timber uses of the forest, the permanent closure Southeast's two pulp mills, the ending of their long term contracts, and the significant amount of logging that has already taken place, future logging levels on the Tongass National Forest are likely to be significantly lower than they have been in the past. That's a major reason why a change from a volume to a value strategy is necessary. Thus, the industry can no longer expect a “reliable” timber supply to mean a large supply. In fact, in some ways, the smaller the supply, the more reliable it will be.

The “core timber supply” concept has gained a great deal of credibility within the Timber Task Force. In this way of thinking about the timber supply, there is some level of supply that is low-controversy and most reliable for investors to bank on. Another part of the supply will be of medium controversy and less reliable, and a final part of the supply will be more controversial and more speculative. Identifying a core supply that is less controversial will require cooperation among competing forest users, and local Southeast communities. It remains a challenging but promising way of increasing reliability.

The export of private timber and Tongass cedar. Every year, hundreds of millions of board feet of logs are exported from Southeast Alaska, in raw form, without any processing. The logs originate

primarily from private, Native Corporation lands (although logs from State, University of Alaska, and Mental Health Trust lands are also exported), and flow to Asia because they command a higher price in raw form to Asian customers than Southeast Alaskan businesses have been willing to pay. Additionally, yellow and red cedar logs, which comprise a significant fraction of the annual log supply from National Forest lands, are also exported in raw form under current Forest Service regulations.

A major challenge for the industry is to find ways of increasing profitability such that logs from private, State, and Mental Health lands can be purchased at their market value. Perhaps more immediately, phasing out the practice of allowing the export of cedar round logs from National Forest lands will help increase the timber supply and provide new opportunities for value-added manufacturing.

Better log sorting and utilization. The industry's current sorting practices, which have centered around providing large quantities of fiber to pulp mills, need to be reformed to serve the needs of a smaller industry based on secondary manufacture. In a high-value-added timber industry, log sorting and utilization is a much more intensive and careful affair. By modernizing its log sorting practices and utilizing the available supply far more efficiently, industry will reduce its historic dependence on a large supply, and will significantly reduce its anxiety over a diminishing logging level. Thus, some of the responsibility for creating "reliability" in the timber supply lies with the industry itself.

Champion, SEACC, and others have suggested the need for public sort yards where small operators can purchase logs suited to their individual manufacturing needs. This practice, new to Southeast Alaska, will help smaller manufacturers gain a reliable timber source. Other changes in industry methods and infrastructure will also be called for, possibly including, if Champion is right, altered approaches to log transport. However, while industry transition is challenging, no independent observers have suggested that the change from a volume to a value strategy cannot occur in Southeast Alaska.

Competing from Southeast Alaska. It is possible for a high-value-added industry to compete from Southeast Alaska despite longer transport distances. Transportation is not an insurmountable barrier because containerized cargo can be barged by water more cheaply than it can be trucked overland, and because finished products do not depend for sales on small differences in price.¹² By contrast, small differences in price do make a major difference to the saleability of undifferentiated commodity items like pulp or MDF, creating a major hurdle for commodity producers to overcome. Price drops driven by lower-cost competition were a major reason both Southeast pulp mills closed.

Further, it appears that the popular conception that Southeast Alaska's wage rates pose an additional hurdle to industry competitiveness is largely mistaken. According to the draft Timber Task Force report, wage rates in the region are only marginally higher than those of Washington state and lower than those reported for British Columbia.¹³

Summing up. In sum, it seems unrealistic for the industry to expect a large or "guaranteed" timber supply in the future—and therefore, the new, high-value-added industry must be flexible enough to survive without such guarantees. However, it may be possible to increase the reliability of the timber supply with additional communication and cooperation among forest users, the involvement of local communities in planning efforts, the acceptance of the core timber supply concept, and a real willingness on the part of industry to embrace change.

ANSWERING SOME OBJECTIONS TO A SECONDARY MANUFACTURING INDUSTRY

Q. “Tongass wood is of very poor quality. Only half the volume logged in Southeast Alaska can be sawed.”

A. The idea that half the log supply is low-grade pulp wood is an artifact of the era of forced pulping due to the long-term contracts. It is contradicted by the experience in British Columbia and by KPC itself. Martin Pihl, former KPC CEO, told the Ketchikan Chamber in 1993 that KPC was running 85-90% of their log supply through their sawmills. In 1996, KPC claimed that the “best” distribution of the timber supply is only 30% pulp, 55% saw, and 15% cedar (implying round-log export).¹⁴

Moreover, roughly half of this 30% would be small-diameter hemlock sawlogs, which can be sawn using standard technology to yield 42%-48% of total cubic volume in surfaced, dried lumber of good quality.¹⁵ Roughly 15% of Tongass logs are “utility” logs, as opposed to sawlogs. We assume 20% here.

In British Columbia, 92% of the logged volume goes to sawmills for sawing first. Only 5% goes straight to the chipper.¹⁶ Fiber-based processes such as pulp mills obtain their supplies from chipped sawmill residues, not chipped logs. However, after all processing is done, roughly 62% of the total volume processed winds up as solid wood, and 38% of the cubic volume of timber processed winds up as sawmill waste and chips. This means that you can saw the vast majority of your logs, but you still end up with a significant amount of waste and chips.

Q. Then isn’t a big fiber plant necessary?

A. No. Sawmill waste and chips can be disposed of in a variety of ways, so that sawmills and secondary manufacturers can continue to operate without being swamped. Big fiber plants producing commodity products like MDF must compete against enormous economy-of-scale and cost advantages from international producers, and they tend to centralize and dominate the industry.

Q. Isn’t it impossible to compete from Southeast Alaska?

A. Transportation is not an insurmountable barrier because containerized cargo can be barged by water more cheaply than trucked overland, and because finished products do not depend for sales on small differences in price for identical items, which is the case in commodity products.

CONCLUSION

The Southeast Alaska timber industry is in the midst of a fundamental structural transition. As in the Pacific Northwest and British Columbia, an industry which was based on volume—the cutting and primary-processing of large numbers of trees—is faced with the need to re-invent itself as a very different, value-based industry—one that cuts fewer trees but does more with each tree cut. Transition in the industry, implicitly or explicitly recognized by several recent reports, appears to be starting in earnest with the ground breaking on the new Seley Log and Lumber mill.

There should be no turning back. The volume-to-value transition holds the promise of allowing a timber industry to continue while providing for the conservation of Tongass National Forest non-timber resources that are increasingly important to Americans both inside and outside Alaska. Since holding back this tide of change is neither possible nor desirable, Southeast Alaskans must now determine how to steer our ship in a way that will bring us all home to safe harbor—with a different timber industry that produces products and jobs within the region as it coexists with other users of the forest; and with the fish, wildlife, and other magnificent resources of Southeast Alaska conserved for ourselves, our children, and future generations of Alaskans.



Nick Olmsted of Tenakee Springs, Alaska puts the finishing touches on his hemlock speaker boxes. High value-added specialty products like this could fill an important niche in a smaller-scale Tongass timber industry.

ENDNOTES

¹ This paper was presented in draft form, minus the Summary, Recent Developments and Conclusion sections of this final version, but including all modeling, to the Governor of Alaska's Southeast Regional Timber Task Force on December 12, 1996.

² From *Challenges and Responses: the British Columbia Forest Industry in the Late 1980's*, paper presented to "The Future of the Timber Industry in Southeast Alaska," a conference sponsored by the University of Alaska-Southeast and the Ketchikan Chamber of Commerce, Ketchikan.

³ Structure and Significance of the Value-added Wood Products Industry in British Columbia, Canada-British Columbia Partnership Agreement on Forest Resource Development, January 1993 at iii and 19.

⁴ CINTRAFOR Fact Sheet #13, August 1994.

⁵ The Evergreen Partnership, Prospectus at 1.

⁶ Greg Schellberg, Evergreen Partnership Executive Director, workshops sponsored by the Southeast Alaska Conservation Council in Ketchikan and Wrangell, February 1996.

⁷ Source: Product Recovery From Hemlock "Pulpwood" From Alaska. US Forest Service Pacific Northwest Forest and Range Experiment Station, January 1983.

⁸ Note: Sawing small diameter hemlock sawlogs produces a 100% overrun in the Forest Service's 1986 lumber-yield test. We stick with the generally accepted 30% figure here.

⁹ Draft Timber Task Force report at 4.

¹⁰ Id. at 33-42.

¹¹ Id. at 54.

¹² For example, shipping knockdown furniture from Southeast Alaska to a European customer would add just \$0.99 per piece to the cost of an actual shipper of such furniture from British Columbia. Because pieces of furniture differ in design, this amount would clearly not prevent a consumer from buying the marginally more expensive piece.

¹³ Draft Timber Task Force report at 23.

¹⁴ Source: "Questions Regarding the Continued Operation of Ketchikan Pulp Company," written hearing testimony, Senate Energy and Natural Resources Committee, ____ 1996.

¹⁵ Source: Product Recovery From Hemlock "Pulpwood" From Alaska. US Forest Service Pacific Northwest Forest and Range Experiment Station, January 1983. Small-diameter hemlock sawlogs, which historically have often been pulped, can be sawn using standard technology to yield 42%-48% of total cubic volume in surfaced, dried lumber of good quality.

¹⁶ Source: Forest Alliance of British Columbia, 1996. Why Wood? (Statistics on the B.C. forest products industry, compiled from the BC Ministry of Forests).